Appendix 3

Excerpts from "Baseline Ecological Risk Assessment: Former ASARCO East Helena Facility East Helena, Montana" (Gradient, 2010b)

DRAFT

Baseline Ecological Risk Assessment:

Former ASARCO East Helena Facility
East Helena, Montana

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Gradient

is to the north and northwest (Hydrometrics, 2010). Site groundwater receives recharge from Upper Lake and Lower Lake in the plant area and from Prickly Pear Creek in the area immediately downstream of the plant site. Groundwater investigations have been documented elsewhere in the BERA (ACI, 2005; Hydrometrics, 2010) and the primary findings are as follows:

- The primary aquifer on and downgradient of the Facility is an unconfined to semiconfined aquifer occupying unconsolidated alluvial/colluvial sediments.
- The majority of the Facility is underlain by a single sand and gravel aquifer with the aquifer base defined by a low permeability silt/clay layer.
- In the northern portion of the Facility, the aquifer becomes thicker with discontinuous fine-grained (silt) lenses occurring within the primary upper aquifer.
- In previous investigations (ACI, 2005), the upper aquifer was divided into a shallow aquifer and deeper "intermediate" aquifer based on the presence of these fine-grained lenses.
- Groundwater flows in a north to northwest direction from the Facility toward and west of East Helena.
- Primary sources of groundwater recharge include seepage from Upper Lake on the Facility and seepage from Prickly Pear Creek north of the Facility. Other sources of recharge include precipitation recharge and groundwater inflow to the alluvial/colluvial aquifer from the surrounding foothills comprised of finer-grained tertiary sediments.
- Monitoring results have detected elevated As concentrations in the shallow aquifer, with the mapped plume trending from the Facility to the north and northwest. Previously identified As source areas include Lower Lake and the Speiss-Dross Plant Area, Former Acid Plant, and Acid Plant Sediment Drying (APSD) Areas. All of these source areas have been the focus of extensive remediation efforts, including the recent (2006/07) encapsulation of contaminated soils in the Speiss-Dross and APSD areas within slurry walls (keyed into the underlying silt/clay layer) and temporary caps.
- In the past few years, elevated concentrations of Se have also been detected in the shallow aquifer extending from the Facility to the north and northwest.

2.4.4 Ecological Resources

The Facility is located primarily on the Prickly Pear Creek alluvial plain and is bounded to the south by Upper Lake, Upper Lake Marsh, and Lower Lake, to the east and northeast by Prickly Pear Creek, and on the west and southwest by uplands or foothills (Map 2). The Prickly Pear Creek watershed is part of the Missouri River basin. Prickly Pear Creek flows along the east and northeast boundaries of the study area from its headwaters in the Elkhorn and Boulder Mountains (about 30 miles south and west of the site) northward to Lake Helena (approximately seven miles north of the Facility) (US FWS, 1997; Hydrometrics, 2010). Prickly Pear Creek has been impacted by historical mining activities (upstream of

and not associated with the Facility) resulting in elevated concentrations of some metals in stream water and sediments upgradient from the Facility as documented in other investigations (MDEQ, 2006; US EPA, 1985a; US FWS, 1997). Further details on the areas and habitats that are the focus of the BERA are presented below.

Prickly Pear Creek (Includes Stream Reference Area)

Prickly Pear Creek flows along the eastern Facility boundary, north toward the town of East Helena (refer to Maps 1 and 2). Base flow in Prickly Pear Creek is typically 25-30 cubic ft per second (cfs). Peak flows near the site during spring and early summer runoff have ranged from near 50 to greater than 300 cfs. In general, Prickly Pear Creek is characterized by alkaline pH (average pH values for individual water quality monitoring stations range from 6.8-8.2) and moderately low concentrations of dissolved solids (average total dissolved solids [TDS] ranges from 158 to 192 mg/L).

Synoptic streamflow measurements have been recorded seasonally in Prickly Pear Creek over the past several years. Streamflow data from these sites indicate that rates of groundwater recharge to the creek (or creek losses to groundwater) are small in comparison to the overall streamflow rates. Similar to the streamflow data, the surface water and groundwater quality data suggest that any influence of groundwater on the creek water quality is subtle.

Figure 2.3
Prickly Pear Creek Adjacent to the Facility

Prickly Pear Creek has been a source of water for agriculture, mining, and industrial use for more than a century (ASI, 2005), and its water quality is monitored regularly as part of the site's Comprehensive Post-RI/FS monitoring program. According to the Comprehensive RI/FS (Hydrometrics, 1990), the creek is influenced by acid mine drainage in mining areas toward its headwaters and by railroad and highway construction, residential subdivision development, agricultural diversion and dewatering, and municipal and industrial discharges. From July through September, Lower Prickly Pear Creek downstream of East Helena is severely dewatered by irrigation demands, and, during this time, it often becomes nearly or completely dry. The creek supports a trout fishery upstream of East Helena, but summer dewatering and sewage treatment effluents severely limit the creek's ability to support trout downstream of East Helena.

The creek suffers numerous water quality impairments due to metals, sediment loads, nutrients, high temperatures, and lack of instream flow. Prickly Pear Creek is listed as chronically dewatered by the Montana Department of Fish, Wildlife and Parks (MFWP), and the MDEQ has issued numerous Total Maximum Daily Loads (TMDLs) or beneficial use impairments for the stream (Montana Water Trust, 2008).

Data on TMDLs and designated uses of Prickly Pear Creek were obtained from US EPA's Water Quality Assessment and TMDL information website. The overall status of Prickly Pear Creek is listed as "Impaired" as of reporting year 2006. Designated use groups with impaired status for the creek are listed as agricultural, aquatic life, cold water fishery, drinking water, industrial, primary contact recreation, and warm water fishery. The causes of impairment in Prickly Pear Creek are listed as alteration of riparian vegetation, ammonia inputs, metals, low-flow alterations, nutrient inputs, substrate alterations, sedimentation, and temperature impacts. US EPA's Water Quality Assessment listed sources that are likely contributing to impairment in the creek, including acid mine drainage and impacts from abandoned mine lands, sediment contamination due to legacy/historical pollutants, grazing in riparian zones, habitat modification, irrigation demands, and municipal treatment systems.

Seepage from Lower Lake *via* groundwater historically contributed to increased metals concentrations in the creek adjacent to the Facility. Although the Prickly Pear Creek channel is immediately adjacent to the Slag Pile, and erosion of slag is possible during extremely high flow events, long-term monitoring has not indicated measurable impacts on water quality over this reach due to the presence of the Slag Pile. The Comprehensive RI/FS (Hydrometrics, 1990) concluded that the only measurable impacts from the site to Prickly Pear Creek water quality were from seepage from Lower Lake.

Figure 2.4
Impounded Area of Prickly Pear Creek
East of Lower Lake

Habitat characterizations of Prickly Pear Creek upstream of and adjacent to the Facility have been conducted for ongoing site investigations (Western Technology and Engineering, Inc., 1989; US EPA,

2005a; GEI and Gradient, 2010). The most recent habitat examination was conducted as part of the 2010 ecological investigation supporting the BERA; a copy is provided in Appendix A. In 2010, a survey (see Appendix A for a copy of the field report) of Prickly Pear Creek adjacent to the Facility identified six different habitat types present in this reach (runs, low gradient riffle, high gradient riffle, scour middle artificial, damned main artificial, and bridge/dam outfall). Three of these habitat areas are associated with the damned area and bridge east of Lower Lake (Map 2). Stream widths varied widely throughout the reach (6-37 m), with the narrowest portions associated with the riffle habitats, intermediate portions associated with the run habitats, and widest portions associated with the areas adjacent to the dam. Average stream depths ranged from 40-65 cm with a maximum > 150 cm.

The predominant bank cover type present along Prickly Pear Creak includes willow, sedges, grasses, trees, gravels, cobbles, and boulders. Substrates above the dam were dominated by cobble while those below were dominated by sand. Percent fines by grid measurements followed the same trend, decreasing from a maximum of 31% to a minimum of 3% upstream of the dam, and increasing from 98% to 100% below the dam.

Terrestrial habitat features were also evaluated in the riparian area surrounding Prickly Pear Creek adjacent to the Facility. The areas east of the Slag Pile, Lower Lake, and Upper Lake are heavily disturbed. Average vegetation height was greater than 1 m and was dominated by a moderately-diverse assemblage of shrubs (*i.e.*, greater than 50%), though some grasses were also present as were a few scattered trees.

Figure 2.5
Prickly Pear Creek Upstream of East Helena Facility

Prickly Pear Creek upstream of the Facility (south) was used as a stream reference area for the BERA. The 2010 ecological field investigation collected habitat and chemistry data from several locations along the upstream stretch of the creek (locations shown on Map 4; photographs in Appendix A). Two different habitat types were present in this reach: four runs, and two low gradient riffles. Stream widths were consistent throughout the reach, with both the average wetted (7-8 m) and bank widths (11-12 m) only varying by 1 m across the two habitat types. Average depths

were 37-50 cm with a maximum depth of 78 cm. Eroding banks (3-9 m) were observed in the majority of the habitat units. The predominant bank vegetation type present along the upstream portions of Prickly Pear Creek was trees and grasses. Substrates were overwhelmingly sandy, with some areas of cobble and gravel. Percent fines varied between 14-40% fines by grid.

Terrestrial vegetation along the upstream portion of Prickly Pear Creek included trees, shrubs, and grasses. Average vegetation height was greater than 1 m in the immediate riparian zone where riparian trees and shrubs extended approximately 20 ft up the bank. Beyond this zone, herbaceous vegetation and grasses ranging from 0.15-1 m in height were present. A moderate diversity of five to 15 common plants was observed, though greater than 50% was shrubland in the riparian area immediately adjacent to the Creek.

Upper Lake Marsh

Upper Lake and its associated marsh lie at the southern end of the property (Map 2) and cover approximately 50 acres. The marsh is fed through a diversion of flow from Prickly Pear Creek. In general, the emergent marsh area is covered with water ranging from a few inches to 2 ft deep. The sediment in the marsh is reported to be anaerobic, which would be typical for this type of environment (US EPA, 2005a). From general observations made during the September 2008 site visit, the sediment in the lake appears to be fine-grained and mucky, and the lake supports emergent and submerged aquatic vegetation (Gradient, 2010).

Figure 2.6
Upper Lake Marsh

The Upper Lake Marsh is comprised of two habitat zones: predominantly palustrine wetlands and forested stands along the diversion from Prickly Pear Creek (Western Technology and Engineering, Inc., 1989; GEI and Gradient, 2010). The riparian zone in the forested area has deciduous vegetation in the understory, sparse trees of mixed sizes, and only sparse or moderate quantities of woody shrubs and saplings and tall herbs, forbs, and grasses (Appendix A). Ground cover in the palustrine areas are heavily comprised of inundated vegetation, though sparse woody shrubs and seedlings, herbs, forbs, and grasses are also present. The shoreline substrate is

heavily vegetated, though moderate amounts of fine soil/sediment are also present. The angle of the bank around the perimeter of the marsh is ≤ 30°. All marsh habitats consisted of a plant assemblage with low diversity including mostly cattails, plus one to two other shrub species and a few scattered trees. Correspondingly, average vegetation height was over 1 m.

The littoral zone bottom substrate is dominated by silt clay/muck materials, though at some sites sparse to moderate quantities of sand and woody debris can be found (Appendix A). Upper Lake Marsh substrates are black in color and have an anoxic odor. A sparse to moderate amount of submergent and floating macrophytes is present throughout. Sparse or moderate to very heavy density fish cover is present in the forms of aquatic weeds, snags, brush or woody debris, and overhanging vegetation. Finally, fish habitat includes both human and natural features, consisting of both open and covered areas made up of vegetated and/or mixed structures.

Upper Lake

Upper Lake is located at the extreme southern (hydrologically upgradient) end of the Facility (Map 2) and is fed through diversion of flow from Prickly Pear Creek. Upper Lake discharges *via* return flow to the creek, seasonal discharge to the Wilson irrigation ditch, and through subsurface leakage to the local groundwater system. Upper Lake has been identified as a significant source of recharge to the groundwater system underlying the Facility. Data from the Comprehensive RI/FS (Hydrometrics, 1990) showed that water quality in Upper Lake was essentially the same as Prickly Pear Creek upstream of the Facility. As noted in the Comprehensive RI/FS, historical mining impacts are well documented and are a major source of metals to Prickly Pear Creek. Elevated concentrations of metals occur in Upper Lake sediments, with higher concentrations than those in Prickly Pear Creek both upstream and downstream of the site.

Figure 2.7
Upper Lake Facing Southwest

Figure 2.8
Upper Lake Facing North

The open water portion of upper lake covers approximately 20 acres and depths range from 5-12 ft (Hydrometrics, 2010; Western Technology and Engineering, Inc., 1989; US EPA, 2005a). Habitat characterization was conducted in 1989 (Western Technology and Engineering, Inc., 1989) and in 2010 (see Appendix A for field report). The edges of the Upper Lake can be characterized as palustrine wetlands with an unconsolidated muddy bottom or aquatic bed with rooted vegetation (Western Technology and Engineering, Inc., 1989). The investigation in 2010 identified that the riparian zone had either deciduous vegetation or no vegetation at all in both the canopy layer and understory. Where vegetation was present, the canopy layer included a sparse number of trees with a diameter at breast height (DBH) $\leq$ 0.3 m, whereas trees with a DBH greater than or equal to 0.3 m were absent. The understory consisted entirely of woody shrubs and saplings; tall herbs, forbs, and grasses were absent. Ground cover was generally barren, though sparse herbs, forbs, grasses and woody shrubs and seedlings were observed at some Upper Lake areas. Inundated vegetation was observed to a moderate extent throughout the Upper Lake.

The shoreline substrate zone is predominantly fine soil/sediment and/or loose sand, though cobble/gravel and vegetated portions of the shoreline were also observed. The angle of the bank around the perimeter was steep (*i.e.*, between 30° and 75°) at all sites. The littoral zone bottom substrate is dominated by silt clay/muck materials, though at some sites sparse and/or moderate quantities of cobble, gravel, sand, and/or woody debris were also observed. Upper Lake substrates are black in color and have an anoxic odor. A heavy to very heavy amount of submergent and a sparse amount of floating macrophytes were observed throughout the Lake. Sparse or moderate to very heavy density fish cover was present in the forms of aquatic weeds, brush or woody debris, overhanging vegetation, and human structures. Finally, fish habitat included both human and natural features consisting of covered areas made up of vegetated structures.

The Upper Lake bank vegetation was (on average) greater than 1 m. Upland plant assemblages surrounding the lake were dominated by grasses and shrubs (*i.e.*, willows), while riparian plants included mostly cattails. Among these plants was a moderate diversity of five to 15 common species with 15-50% being shrubs and only a few scattered trees. Human influences are also apparent on the banks in the form of buildings, commercial facilities, walls/dikes/revetments, litter/trash dumps/landfills, roads/railroads, and pastures/hayfields.

Wilson Ditch

Wilson Ditch is an agricultural irrigation ditch extending from Upper Lake northwestward towards the Helena Valley (Map 2). Wilson Ditch is used to convey irrigation and stock water from Prickly Pear Creek to fields northwest of the site. Prior to 1997, Wilson Ditch crossed the Facility in a buried concrete pipe. In 1997, the original pipe was replaced with an underground pipeline relocated immediately south of the Facility. The new ditch route from Upper Lake eliminated the potential for water from the site to affect Wilson Ditch. Phase I RFI data collected in 2001 and 2002 showed that water quality in Wilson Ditch downstream of the Facility was the same as in Upper Prickly Pear Creek (ACI, 2005; Hydrometrics, 2010). In Wilson Ditch, water flows only during the irrigation season (approximately April-September). Measured flows in the ditch during those times are low, ranging from 1.46-8.26 cfs.

Aquatic habitat features were investigated near the underground outlet in the Northwest edge of the site (Appendix A). Three different habitat types were observed in this reach: three runs, four low gradient riffles, and one glide. Stream widths are consistent throughout this reach, ranging from 2-3 m. Average depths ranged from 14-20 cm, with a maximum depth of 28 cm (Appendix A).

Figure 2.9
Wilson Ditch Near Outlet

The predominant bank cover type present along Wilson Ditch includes willow, sedges, grasses, trees, and boulders. Substrates consisting of sand, gravel, and cobble are generally evenly distributed, although fines were recorded as the third most dominant substrate type in the downstream most run and the glide (Appendix A). Percent fines by grid measurements varied widely (9-69%) but generally increased downstream as the habitat transitioned to runs.

Average terrestrial vegetation height was between 0.15-1 meter, owing to the predominant vegetation type of grasses that were approximately 0.75 m tall (Appendix A). A few other herbaceous plants were also present, as were autumn olive shrubs and a few small patches of trees. Moderate species diversity existed among the plant assemblage present at Wilson Ditch, which appeared to be heavily influenced by human activity.

Lower Lake

Lower Lake is a former process water pond located immediately north of Upper Lake. It is a man-made lake covering approximately 7 acres with a capacity of 11 million gallons (Hydrometrics and Hunter/ESE, 1989). The lake was formed in the 1940s by dividing the northern portion of Upper Lake with a berm of fill for the purpose of storing process recirculation water (ACI, 2005). Lower Lake receives recharge from precipitation, groundwater inflow, and treated effluent from the Facility Water Treatment Plant. Outflow from Lower Lake occurs as seepage to the local groundwater system and evaporation. Seepage from Lower Lake has been identified as a historic source of metals loading to groundwater on the Facility and, possibly, to adjacent Prickly Pear Creek. Lower Lake was the focus of an extensive remediation program in the mid-1990s, including dredging of the lake sediments and placement of sediments in an onsite CAMU landfill. As a result, dissolved As concentrations in Lower Lake water have decreased from 10 to 90 mg/L prior to 1995, to approximately 0.20 to 0.30 mg/L today (ACI, 2005; Hydrometrics, 2010).

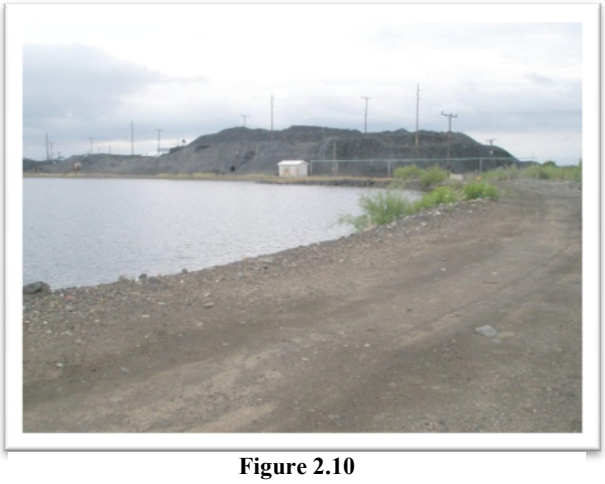

Figure 2.10
Lower Lake Facing Northeast

The relationship between Prickly Pear Creek and Lower Lake is important due to the proximity of Lower Lake to Prickly Pear Creek and the historical use of Lower Lake as a storage pond for excess process water. Extensive water resources monitoring has been conducted in the vicinity of Lower Lake since at least 1985. The seasonal water resources monitoring has generally included collection of groundwater and surface water elevation data, streamflow monitoring in Prickly Pear Creek, and water quality sampling in Lower Lake, Prickly Pear Creek, and the intervening groundwater system. Review and interpretation of these data has been presented in previous documents, including Hydrometrics (1999) and ACI (2005) and is summarized below.

Shallow groundwater (6-60 ft) is present in the alluvial aquifer beneath most of the former Facility and depths generally increase to the north. The depth to groundwater is shallowest near Upper Lake, Lower Lake, and Prickly Pear Creek. Fluctuations in groundwater levels tend to mirror fluctuations in Prickly Pear Creek (ACI, 2005). Groundwater levels generally begin rising in May in response to

spring runoff and gradually increase over the next few months. There is a progressive decline in groundwater levels from September through April; however, water level trends often vary considerably in response to increases in stream flow in Prickly Pear Creek (ACI, 2005). Groundwater flow or seepage was reported from the eastern edge of Lower Lake to Prickly Pear Creek (ACI, 2005). A review of the water levels at the north end of the Facility suggested that some groundwater flow is lost as recharge to Prickly Pear Creek at the northeast boundary of the Facility. However, any gains or losses to Prickly Pear Creek were within the error of flow measurement of the creek, and flow gains or losses to the Creek were not measurable (ACI, 2005).

Monitoring well DH-11, located across Prickly Pear Creek to the northeast of Lower Lake, indicated an increasing trend in sulfate, chloride, and total dissolved solids concentration over three years, corresponding to an increase for the same constituents observed in Lower Lake (ACI, 2005). The sulfate concentration trend indicated that the influence of Lower Lake on shallow groundwater may extend across Prickly Pear Creek in this region. However, As concentrations at DH-11 have typically been low at this location (<0.005 mg/L) even when Lower Lake previously exhibited elevated As concentrations. Examination of surface water concentration data indicated exceedances of water quality criteria in the area of Prickly Pear Creek influenced by Lower Lake seepage (ACI, 2005). This pathway is investigated further in the BERA.

Lower Lake has a gravel and sand bottom, limited presence of shoreline and aquatic vegetation, and it appears to provide very poor aquatic habitat (Gradient, 2010; Western Technology and Engineering, Inc., 1989; US EPA, 2005a; GEI and Gradient, 2010). In the 2010 ecological investigation (Appendix A), the riparian zone was characterized as having a limited amount of deciduous vegetation in the understory and, otherwise, no vegetation present in the canopy or understory. Where riparian vegetation was present, only sparse quantities of trees with a DBH < 0.3 m, woody shrubs and saplings, and tall herbs, forbs, and grasses were observed (Appendix A). Ground cover along the perimeter of Lower Lake is mostly barren with few herbs, forbs, and grasses. Sparse quantities of woody shrubs and seedlings, inundated vegetation, and herbs, forbs, and grasses also contributed to the ground cover in some areas (Appendix A). The shoreline substrate around Lower Lake consists of a mix of several materials, including boulders, cobble/gravel, loose sand, fine soil/sediment, vegetation, and other non-natural features. The angle of the bank around the perimeter is ≤ 30°.

Similar to the riparian zone shoreline substrate composition, the littoral zone bottom substrate is also a mix of materials, including boulders, cobble, gravel, sand, silt clay/muck, and woody debris. Lower Lake substrates are either black or brown in color and most have an anoxic odor. Macrophytes are generally absent in the lake and only a sparse amount of submergent and floating macrophytes have been observed (Appendix A). Fish cover is generally absent; however, a few areas have sparse or moderate to very heavy density fish cover in the form of brush or woody debris, rock ledges or sharp drop-offs, boulders, and human structures. Correspondingly, fish habitat is generally open with artificial structures making up the only covered areas.

Tito Park

South of Lower Lake, between Lower Lake and Upper Lake, is a disturbed, sparsely vegetated area (called "Tito Park" by Facility personnel) that provides minimal upland habitat (Map 2). The soils in this area are disturbed, and there is little cover for ecological receptors. Due to the availability of more desirable habitat in the marsh area surrounding Upper Lake and along the riparian edge of Prickly Pear Creek, it is unlikely that this disturbed area receives substantial use by ecological receptors.

Figure 2.11
Tito Park Facing West

Remediation activities in the area between Upper and Lower Lakes began in 1991/92 with removal of the acid-plant sediments from the sediment drying pad in the extreme western portion of this area. In 2001, additional stockpiled soils and debris piles were removed from the area between Upper and Lower Lakes and placed in the Phase I CAMU. The area was then regraded and capped with 12 inches of clay soil obtained from the Phase I CAMU clay liner stockpile (permeability of 10^{-7} cm/sec or less). The clay cap is graded so that stormwater runoff drains westward to the site, where the runoff is collected for treatment in the Facility water treatment plant. In 2006, a slurry wall was constructed in the extreme western portion of the site to isolate subsurface soils in the former acid plant area (ASARCO, 2008). The slurry-wall area is covered with a temporary plastic liner about 1 acre in area, and the temporary cap is to remain in place until a final site cap is constructed.

The Tito Park area was surveyed in 2010 (Appendix A). Average vegetation height was < 0.15 m, reflecting grasses as the predominant vegetation type. Species diversity was low, with only one shrub, two to three grasses, and one herbaceous species being present. There were no trees present in this heavily disturbed area, which was situated between two roads used to access the Facility and the Slag Pile. During the 2010 habitat characterization, a notable lack of terrestrial invertebrates (particularly earthworms) was observed in this area. This is likely due to the clay cap (clay soils are generally very dense and are therefore problematic for burrowing earthworms) and dry conditions in this area (Appendix A).

Site Perimeter

Facility operations and emissions may have affected upland areas both on and off the Facility (US EPA, 2005a; Gradient, 2010). Terrestrial habitat at the site is limited to onsite areas near buildings, former operations and stockpile areas (including the area between Lower and Upper Lakes, "Tito Park"), and the open ranchland adjacent to the Facility (Map 2). The onsite areas provide limited habitat for common species such as rabbits, squirrels, mice, and pigeons. The adjacent ranchland, which may have been affected by historical smelter emissions, likely provides habitat for deer, small mammals, and upland game birds and predators (including red-tailed hawks, coyotes, and foxes), and supports livestock (primarily cattle).

Figure 2.12
Site Perimeter (Northwest Corner)

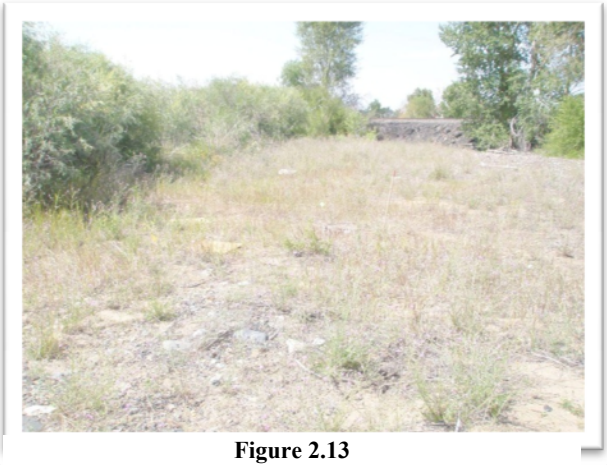

Figure 2.13
Site Perimeter (Northeast Corner)

On the eastern side of the Facility, terrestrial habitat features are similar to those observed near Prickly Pear Creek. Along the creek are vegetated areas with trees, shrubs, and grasses. Vegetation becomes more sparse with distance from the creek and turns to pastureland to the east. The north side of the Facility is bordered by US highway 12 and to

the south by Upper Lake and Upper Lake Marsh. On the west side of the Facility are pastures and vegetated areas such as those surrounding Wilson Ditch. Vegetation is predominately comprised of grasses with a few other herbaceous plants and a small patches of trees. Notable signs of human activity around the site include paved roads, Facility buildings, other commercial and industrial facilities, private residences, and evidence of trespassing along the site perimeter (Appendix A).

Walker Creek (Lake Reference Area)

A lake reference area was identified during the 2010 ecological investigation for comparison to lake and upland areas sampled at the Facility. The Walker Creek watershed was suggested as a location with similar properties as locations onsite and with no known contamination sources by US EPA personnel. Walker Creek is located approximately 17 miles west of East Helena (Map 1). At this location, Walker Creek discharges to a small pond with marsh habitat along the fringes of the pond and creek input.

Figure 2.14
Walker Creek, Pond, and Marsh

A habitat characterization of the Walker reference site was conducted in 2010 (Appendix A). The riparian zone has a mix of deciduous and coniferous vegetation in both the canopy layer and understory. The canopy layer includes a sparse or moderate number of trees with a DBH $\leq$ 0.3 m, whereas trees with a DBH $\geq$ 0.3 m were generally absent or sparse. The understory consists of woody shrubs and saplings to a moderate extent, and tall herbs, forbs, and grasses are present more sparsely. Ground cover at the Walker site is heavily comprised of herbs, forbs, and grasses, while woody shrubs and seedlings are present to a moderate or sparse extent. Inundated vegetation is present, and the shoreline substrate zone is predominantly vegetated, though sparse amounts of boulders, cobble/gravel, loose sand, and fine soil/sediment were observed around the Walker site (Appendix A).

The littoral zone bottom substrate is dominated by sandy and/or silt clay/muck materials and some sites have sparse quantities of boulders, cobble, and gravel. All substrates were either brown or black in color and none emitted any kind of odor (Appendix A). Submergent and floating macrophytes were observed throughout the site. Sparse or moderate to heavy density fish cover was present in the

form of aquatic weeds, brush or woody debris, overhanging vegetation, rock ledges or sharp drop-offs, and docks. Finally, fish habitat includes both human and natural features consisting of both open and covered areas, made up of vegetated, woody, and/or artificial structures (Appendix A).

Terrestrial vegetation height varied from 0.15-1 m where grasses and wildflowers were present (approximately 50% of habitat area) and was > 1 m were shrubs were present (the other approximately 50% percent of habitat area) (Appendix A). Species diversity was moderate in the area surrounding the lake where alternating sections of shrubs and grasses/wildflowers were present. No trees were observed in the riparian area immediately surrounding the Walker site, but evergreens approximately 50 ft tall were scattered throughout the area 10-15 ft beyond the riparian area.

2.5 Species Presence and Habitat Use

The ecological habitats at the Facility and surrounding areas have been modified by industrial and remedial activities. Still, many invertebrate, fish, bird, mammal, amphibian, reptile, and plant species use habitats that occur within the BERA study Area (Map 2). The following subsections present an overview of the various aquatic and terrestrial biological communities in the study area. The species reported to be present or observed at the site and corresponding habitat use are also described.

Benthic Invertebrates

Invertebrate communities in aquatic systems (such as Prickly Pear Creek, Upper Lake, Upper Lake Marsh, and Lower Lake) are functions of physical, chemical, and biological interactions. The composition of invertebrates in aquatic systems tend to be greatest where habitats are varied with some moderate, predictable disturbances (*e.g.*, seasonal flooding) (Thorp and Covich, 2010). Invertebrates in aquatic systems are predominantly benthic; those that burrow within a soft substrate are typically referred to as infauna, while those that live on the sediment or other hard surface are called epifauna. Benthic macroinvertebrate communities tend to be dominated by members of the phylum *Arthropoda*, which includes insects, mites, amphipods, copepods, and crayfish. Other phyla such as *Mollusca* (*e.g.*, clams, mussels, and snails), *Annelida* (*e.g.*, oligochaete worms, polychaete worms, and leeches), and *Platyhelminthes* (flatworms) are important members of the benthic community. Benthic invertebrates have varying feeding preferences, including grazers (which feed on periphyton and macrophytes), shredders (which process organic material), filter feeders (which process suspended organic material),

predators (which prey on other invertebrates and small fish), and parasites (which feed on other organisms).

Qualitative and quantitative observations of benthic invertebrate communities have been conducted at the site by US EPA (2005a) and GEI and Gradient (2010). The primary benthic invertebrate taxa observed within the aquatic portions of the site included *Ephemeroptera*, *Plecoptera*, and *Trichoptera* (collectively referred to as EPT), *Coleoptera*, *Diptera*, *Amphipoda*, *Odonata*, and *Hemiptera* (GEI and Gradient, 2010; US EPA, 2005a; US FWS, 1997). Other taxa encountered during site investigations included *Acari*, *Bivalvia*, *Crustacea*, *Gastropoda*, *Hirudinea*, *Megaloptera*, and *Tubificidae* (GEI and Gradient, 2010; Appendix A). A benthic community analysis was conducted by US EPA (2005a) and a number of benthic invertebrate species were identified in samples collected from Prickly Pear Creek, Upper Lake, and Upper Lake Marsh (Table 2.14). The 2010 ecological investigation (Appendix A) noted the same invertebrate taxa as reported by US EPA (2005a). In addition, invertebrate groups noted in Lower Lake in 2010 included *ephemeroptera*, *trichoptera*, *coleopteran*, *dipteral*, *odonata*, *amphipoda*, *hemiptera*, *acari*, *gastropoda*, and *hirudinae*. Samples from Wilson Ditch included *ephemeroptera*, *plecoptera*, *trichoptera*, *coleopteran*, *diptera*, *amphipoda*, *hemiptera*, *gastropoda*, and *hirudinae* (Appendix A). Based on these site investigations, it is apparent that aquatic portions of the site are able to support a diverse mix of benthic invertebrate species.

Table 2.14
Benthic Invertebrate Species Identified in Prickly Pear Creek, Upper Lake, and Upper Lake Marsh in 2003 (US EPA, 2005a)

Order[a]	Taxa	Species	Feeding Group[b]	Prickly Pear Creek (upstream)	Prickly Pear Creek (adjacent to site)	Upper Lake	Upper Lake Marsh
Acari	Unknown	Unknown	PR	x			
Amphipoda	Talilridae	Gammarus spp.	GC			x	
Amphipoda	Talilridae	Hyalella azteca	GC	x		x	x
Cladocera	Daphnia	Unknown	FC			x	
Coleoptera	Chrysomelidae	Donacia spp.	SH		x		
Coleoptera	Dytiscidae	Unknown	PR		x	x	
Coleoptera	Elmidae	Cleptelmis ornata	GC	x	x		
Coleoptera	Elmidae	Cleptelmis ornata	GC	x	x		
Coleoptera	Elmidae	Heterlimnius corpulentus	GC	x			
Coleoptera	Elmidae	Heterlimnius corpulentus	GC	x			
Coleoptera	Elmidae	Lara spp.	SH	x			
Coleoptera	Elmidae	Optioservus quadrimaculatus	SC	x	x		
Coleoptera	Elmidae	Optioservus quadrimaculatus	SC	x	x		
Coleoptera	Elmidae	Stenelmis occidentalis	SC, OM	x	x		
Coleoptera	Elmidae	Zaitzevia parvula	GC	x	x		
Coleoptera	Elmidae	Zaitzevia parvula	GC		x		
Coleoptera	Haliplidae	Haliplus spp.	SH			x	
Coleoptera	Haliplidae	Haliplus spp.	SH			x	
Decapoda	Unknown	Unknown	SH, OM			x	
Diptera	Ahericidae	Atherix spp.	PR		x		
Diptera	Ceratopogonidae	Probezzia spp.	PR	x			
Diptera	Chironomidae	Nostocoladius spp.	SH	x			
Diptera	Chironomidae	Unknown	PR, GC		x		
Diptera	Chironomidae	Unknown	PR, GC			x	x
Diptera	Dolichopodidae	Dolichopus spp.	PR	x			
Diptera	Muscidae	Lisppoides spp.	PR		x		
Diptera	Pelecorhynchidae	Glutops spp.	PR	x	x		
Diptera	Psychodidae	Pericoma spp.	GC	x			
Diptera	Simuliidae	Prosimulium spp.	FC		x		
Diptera	Simuliidae	Simulium spp.	FC	x	x		
Diptera	Simuliidae	Simulium spp.	FC		x		
Diptera	Tipulidae	Antocha spp.	GC	x	x		
Diptera	Tipulidae	Dicranota spp.	PR	x			
Diptera	Tipulidae	Hexatoma spp.	PR		x		
Diptera	Tipulidae	Tipula spp.	SH		x		
Diptera	Tipulidae	Tipula spp.	SH				
Epemeroptera	Caenidae	Caenis spp.	GC				
Epemeroptera	Siphlonuridae	Siphlonorus spp.	GC			x	x
Ephemeroptera	Baetidae	Baetis spp.	GC, SC	x	x		
Ephemeroptera	Ephermerellidae	Caudalella spp.	GC	x			
Ephemeroptera	Ephermerellidae	Ephemeralla spp.	GC	x	x		
Ephemeroptera	Ephermerellidae	Orunetla spp.	SC, PR	x	x		

Order[a]	Taxa	Species	Feeding Group[b]	Prickly Pear Creek (upstream)	Prickly Pear Creek (adjacent to site)	Upper Lake	Upper Lake Marsh
Ephemeroptera	Heotageniidae	Slenonema spp.	SC	x	x		
Ephemeroptera	Leptohyphidae	Tricoythodes spp.	CG		x		
Ephemeroptera	Leptophlebiidae	Paraleptophlebia spp.	GC	x	x		
Gastropoda	Ancylidae	Ferrissia rivularis	SC		x		
Gastropoda	Ancylidae	Ferrissia rivularus	SC				
Gastropoda	Lymnaeidae	unknown	SC		x		
Gastropoda	Physidae	Physella spp.	SC	x	x		
Gastropoda	Physidae	Physella spp.	SC			x	x
Gastropoda	Planorbidae	Unknown	SC		x		
Gastropoda	Planorbidae	Unknown	SC			x	
Gastropoda	Plelcypoda	Pisidium spp.	FC		x		
Hemiptera	Corixidae	Sigara spp.	GC	x	x		
Hemiptera	Corixidae	Sigara spp.	GC			x	x
Hemiptera	Gerridae	Trepobates spp.	PR		x		
Hemiptera	Notonectidae	Notonecta spp.	PR			x	
Hirundinea	Unknown	Unknown	PR			x	
Odonata	Aeshnidae	Aeshna spp.	PR			x	x
Odonata	Aeshnidae	Boyeria spp.	PR			x	
Odonata	Coenagrionidae	Enallagma spp.	PR			x	
Odonata	Gomphidae	Ophiogomphus spp.	PR		x		
Oligochaeta	Unknown	Unknown	GC	x		x	
Plecoptera	Chloroperlidae	Sweltsa spp.	PR	x			
Plecoptera	Nemouridae	Malenka spp.	SH	x			
Plecoptera	Nemouridae	Zapada cinctipes	SH	x	x		
Plecoptera	Nemouridae	Zapada spp.	SH	x			
Plecoptera	Perlidae	Claassenia sabulosa	PR		x		
Plecoptera	Perlidae	Doroneuris theodora	PR	x			
Plecoptera	Perlidae	Hespperoperla pacifica	PR	x	x		
Plecoptera	Perlodidae	Megarcys spp.	PR	x			
Plecoptera	Perlodidae	Skwala spp.	PR		x		
Plecoptera	Pteronarcyidae	Pteronarcella badia	SH		x		
Plecoptera	Pteronarcyidae	Pteronarcys califomica	SH	x	x		
Tricoptera	Brachycentridae	Brachycentrus spp.	FC, SC	x	x		
Tricoptera	Brachycentridae	Micrasema spp.	SH, GC	x	x		
Tricoptera	Glossosomatidae	Glossosoma spp.	SC	x	x		
Tricoptera	Helicopsychidae	Arctopsyche spp.	FC	x	x		
Tricoptera	Helicopsychidae	Cheumatopsyche spp.	FC		x		
Tricoptera	Helicopsychidae	Helicopsyche borealis	SC		x		
Tricoptera	Helicopsychidae	Hydropsyche spp.	FC	x	x		
Tricoptera	Hydroptilidae	Agraylea spp.	GC			x	
Tricoptera	Lepidostomatidae	Lepidostoma spp.	SH		x		
Tricoptera	Leptoceridae	Oecetis spp.	PR		x		
Tricoptera	Rhyacophilidae	Dolophilodes spp.	GC	x			
Tricoptera	Rhyacophilidae	Rhyacophifa spp.	PR	x	x		
Tricoptera	Rhyacophilidae	Rhyacophila brunnea	PR	x	x		

Notes:

(a) Data obtained from Appendix D of US EPA (2005a).

(b) Feeding groups: GC (gatherer/collector), SC (scraper), SH (shredder), F (filterer), PR (predator), OM (omnivore), PC (piercer).

Fish

The aquatic portions of the Facility and adjacent to the Facility offer a diverse mix of habitats (*e.g.*, stream, lake, and marsh conditions). The range and distributions of fish species is monitored by the State of Montana through the Natural Heritage program (http://mtnhp.org). Fish species that were identified as using habitat on or near the Facility (Table 2.15) can be grouped into the following feeding guilds:

- **Herbivores/omnivores** – fish that feed on vegetation or vegetation and invertebrates;
- **Benthic invertivores** – fish that feed primarily on benthic invertebrates;
- **Insectivore/Piscivore** – fish that feed primarily on invertebrates and insects in the water column and may eat other fish; and
- **Piscivores** – fish that feed primarily on other fish.

Table 2.15
Fish Species Potentially Present in Aquatic Habitat at or near the Facility

Feeding Group	Common Name[a]	Species Name	Feeding Preferences[b]
Benthic invertivore	Mottled sculpin	*Cottus bairdi*	Predominantly benthic invertebrates
Benthic invertivore	Stonecat	*Noturus flavus*	Aquatic insects and small fish
Benthic invertivore	White sucker	*Catostomus commersonii*	Benthic invertebrates and detritus
Herbivore/omnivore	Common carp	*Cyprinus carpio*	Vegetation, detritus, and aquatic organisms
Herbivore/omnivore	Longnose dace	*Rhinichthys cataractae*	Aquatic insects and algae
Herbivore/omnivore	Longnose sucker	*Catostomus catostomus*	Algae and aquatic invertebrates
Herbivore/omnivore	Smallmouth Buffalo	*Ictiobus bubalus*	Aquatic insects, crustaceans, mollusks and plant material
Herbivores/omnivore	Fathead minnow	*Pimephales promelas*	Minute aquatic plants and animals
Insectivore	Bigmouth Buffalo	*Ictiobus cyprinellus*	Plankton, crustaceans, and dipteran larvae
Insectivore	Brook trout	*Salvelinus fontinalis*	Aquatic invertebrates and small fish
Insectivore	Brown trout	*Salmo trutta*	Aquatic invertebrates and small fish
Insectivore	Kokanee	*Oncorhynchus nerka*	Plankton and aquatic insects
Insectivore	Lake Chub	*Couesius plumbeus*	Plankton and small aquatic invertebrates
Insectivore	Mountain whitefish	*Prosopium williamsoni*	Aquatic and terrestrial insects
Insectivore	Rainbow trout	*Oncorhynchus mykiss*	Zooplankton, aquatic insects, and fish
Insectivore	Westslope Cutthroat Trout	*Oncorhynchus clarkia lewisi*	Aquatic insects and zooplankton
Insectivore	Yellow perch	*Perca flavescens*	Aquatic invertebrates and small fish
Piscivore	Burbot	*Lota lota*	Predominantly fish
Piscivore	Largemouth bass	*Micropterus salmoides*	Fish, frogs, and aquatic insects
Piscivore	Smallmouth bass	*Micropterus dolomieui*	Fish, frogs, crayfish, and aquatic insects
Piscivore	Walleye	*Sander vitreus*	Adults feed heavily on small fish and all ages consume aquatic invertebrates

Notes:

(a) The distribution of this species overlaps or is near the Facility according to the Montana National Heritage Tracker (http://mtnhp.org/Tracker/NHTMap.aspx).

(b) Feeding preferences reported in the Montana State Field Guide (State of Montana, 2010).

Although not all of the species listed in Table 2.15 have been observed at or near the Facility, several have been identified or collected during site investigations, including brook trout, brown trout, rainbow trout, mottled sculpin, white sucker, fathead minnow, and longnose dace (US FWS, 1987; US EPA, 2005a; GEI and Gradient, 2010). Most of these species were identified in either Prickly Pear Creek or Upper Lake and Upper Lake Marsh. Since Wilson Ditch is connected to Upper Lake, it is likely that some fish species may enter this water body during the times of the year when water flows in this drainage. A sample of forage fish was collected at the outlet of Wilson Ditch (Appendix A), suggesting that some fish are present in portions of Wilson Ditch during active water flow (approximately April through September). Prior to the 2010 ecological investigation, it was unknown whether fish were present in Lower Lake. Three samples of forage fish (primarily fathead minnows) were collected in 2010 from Lower Lake (Appendix A), indicating that some fish species are indeed present in this water body, even though metals concentrations are known to be elevated (US EPA, 2005a; Hydrometrics, 2010). Thus, a number of fish species are present at or near the Facility and may be exposed to metals or provide a source of metal exposure to higher trophic organisms (*e.g.*, birds, mammals, and humans).

Aquatic and Terrestrial Plants

Aquatic and terrestrial plant communities are used by ecological receptors for foraging, nesting habitat, breeding habitat, and refuge. Chemicals can adversely affect plant species and communities and/or be transferred from plants to higher trophic level species through consumption. The variable habitat (*e.g.*, marsh, riparian, pasture, and arid areas) surrounding the Facility allow for a diverse mix of plant species. Qualitative assessments of aquatic and terrestrial plants were conducted in 1989 and 2010 at the site (Western Technology and Engineering, Inc., 1989; GEI and Gradient, 2010). Dominant vegetation along Prickly Pear Creek included willows, sedges, grasses, and some trees (Appendix A). The wetland and marsh areas surrounding Upper Lake were dominated by willow (*Salix* spp.) and alder (*Alnus* spp.) stands, with some grasses in the drier areas, and cattails (*Typha* spp.) and reeds in the inundated areas (Western Technology and Engineering, Inc., 1989; GEI and Gradient, 2010). Forested wetlands in the southern portion of Upper Lake Marsh near the Prickly Pear Creek diversion included species such as aspen (*Populus tremuloides*), cottonwoods (*Populus deltoides*) and several grass species. Minimal vegetation was noted around Lower Lake, including some grasses, forbs, and shrubs (Appendix A). The Facility perimeter areas and Wilson Ditch were dominated by grasses, shrubs, and small patches of trees, including Russian Olive (*Elaeagnus angustifolia).* A list of the dominant vegetation noted during site investigations is presented in Table 2.16.

Table 2.16
Plant Species Identified at or near the Facility

Common Name	Species Name
Alder	*Alnus* spp.
Aspen	*Populus tremuloides*
Blue Grama	*Bouteloua gracilis*
Bluebunch wheatgrass	*Agropyron spicatum*
Bluegrass	*Poa* spp.
Brome	*Bromus* spp.
Cattails	*Typha* spp.
Cheatgrass	*Bromus tectorum*
Common reed	*Phragmites communis*
Cottonwood	*Populus deltoides*
Currant	*Ribes* spp.
Needle-and-thread	*Stipa comata*
Rose	*Rosa* spp.
Russian Olive	*Elaeagnus angustifolia*
Ryegrass	*Elymus* spp.
Snowberry	*Symphoricarpos occidentalis*
Wheatgrass	*Agropyron* spp.
Willow	*Salix* spp.

Terrestrial Invertebrates

Terrestrial soil invertebrates provide a pathway for the transfer of contaminants in soils to wildlife that forage on these organisms. A rigorous analysis of terrestrial invertebrate species has not been conducted at the site. However, during sampling of terrestrial soil invertebrates in 2010, a number of taxa were identified (Table 2.17, Appendix A). While the purpose of the 2010 ecological sampling was to target soil invertebrates for use in evaluating risks to higher trophic level terrestrial receptors, collection of these organisms was generally unsuccessful (Gradient, 2010, Appendix A). The presence of earthworms was found to be particularly scarce in riparian and terrestrial areas (Appendix A). This may be due, in part, to the arid conditions of the soils at the time of sampling as well as the soil matrix. In some portions of the site (*e.g.*, Tito Park, Lower Lake, site perimeter), soils were completely dry and consisted of clay materials or were heavily compacted. In other areas (*e.g.*, Prickly Pear Creek, Upper Lake Marsh), soil transitioned from very dry and sandy to inundated with a dense willow root zone (Appendix A). All of these conditions are not ideal for earthworm habitat. Other soil invertebrates (*e.g.*, beetles, spiders, slugs) were also scarce and, despite a rigorous sampling effort, only a few of the targeted samples could be obtained over a two-week period (Appendix A). Jumping and aerial insects were observed more frequently during the 2010 ecological sampling event, and some samples were collected to evaluate metal exposure (Appendix A).

Table 2.17
Terrestrial Invertebrate Species Identified at or near the Facility

Common Name	Species Group
Spiders	*Aranea*
Centipedes	*Chlopoda*
Beetles	*Coleoptera*
Snails, slugs	*Gastropoda*
True bugs	*Hemiptera*
Leaf hoppers	*Homoptera*
Wasps	*Hymenoptera*
Moths	*Lepidoptera*
Earthworms	*Lumbricidae*
Lacewings	*Neuroptera*
Dragonflies, damselflies	*Odonata*
Harvestmen (daddy longlegs)	*Opiliones*
Grasshoppers, crickets	*Orthoptera*
Caddisflies	*Trichoptera*

Birds

Numerous bird species inhabit the terrestrial and aquatic areas within and surrounding the Facility. Bird surveys have been conducted at the site during Spring of 1989 (Western Technology and Engineering, Inc., 1989), in 1992 and 1993 by the Audobon Society (see Gradient, 2010), and Summer of 2010 (Appendix A). Bird species that were identified as using habitat on or near the Facility were grouped into the following general feeding guilds:

- **Carnivores** – birds that feed mainly on small mammals, birds, reptiles and amphibians;
- **Insectivores** – birds that feed primarily on flying or terrestrial invertebrates and may eat small amounts of plant material,
- **Herbivores** – birds that feed predominantly on plant material;
- **Omnivores** – bird that feed mainly on plant material and insects;
- **Diving/probing carnivores and omnivores** – birds that usually swim on the water's surface or dive, or probe sediments to feed on invertebrates or a mix of invertebrates, fish, and occasionally plants from the sediment surface; and
- **Piscivores** – birds that feed predominantly on fish.

A summary of the bird species observed at the site, their feeding preferences, and residency status (*i.e.*, typical seasons when birds are present in the East Helena area) is presented in Table 2.18.

Table 2.18
Bird Species Identified at or near the Facility

Feeding Group	Common Name	Scientific Name	Feeding Preferences[a]	Residency Status[a]
Carnivore	American kestrel	*Falco sparverius*	Large insects, small birds, rodents, and snakes	Year-round
Carnivore	Great horned owl	*Bubo virginianus*	Mammals and birds	Year-round
Carnivore	Loggerhead shrike	*Lanius ludovicianus*	Insects, amphibians, small reptiles, small mammals, and birds	Summer
Carnivore	Red-tailed hawk	*Buteo jamaicensis*	Small mammals and snakes	Year-round
Diving/Probing carnivore	American dipper	*Cinclus mexicanus*	Aquatic invertebrates, insects, and occasionally small fish	Year-round
Diving/Probing carnivore	Common goldeneye	*Bucephala clangula*	Aquatic invertebrates and fish	Year-round
Diving/probing carnivore	Lesser scaup	*Aythya affinis*	Mainly aquatic invertebrates	Year-round
Diving/Probing carnivore	Pied-billed grebe	*Podilymbus podiceps*	Fish, crustaceans and aquatic insects	Year-round
Diving/Probing carnivore	Red-necked grebe	*Podiceps grisegena*	Small fish, aquatic invertebrates, and amphibians	Summer
Diving/probing carnivore	Sandpiper spp.	*Calidris spp.*	Aquatic invertebrates	Summer
Diving/Probing Herbivore	Redhead	*Aythya americana*	Mainly aquatic plants	Summer
Diving/probing omnivore	Barrow's goldeneye	*Bucephala islandica*	Aquatic invertebrates, fish eggs, and some seeds and tubers	Year-round
Diving/probing omnivore	Cinnamon teal	*Anas cyanoptera*	Aquatic invertebrates and plants	Summer
Diving/probing omnivore	Common snipe	*Gallinago gallinago*	Aquatic invertebrates, earthworms, and plant material	Summer
Diving/probing omnivore	Franklin's gull	*Leucophaeus pipixcan*	Invertebrates and plant material	Summer
Diving/Probing omnivore	Gadwall	*Anas strepera*	Aquatic vegetation, seeds and aquatic invertebrates	Year-round
Diving/probing omnivore	Green-winged teal	*Anas carolinensis*	Aquatic invertebrates and plants	Year-round
Diving/probing omnivore	Ring-necked duck	*Aythya collaris*	Aquatic invertebrates and plants	Summer
Diving/probing omnivore	Ruddy duck	*Oxyura jamaicensis*	Aquatic invertebrates and plants	Summer
Diving/probing omnivore	Sandhill crane	*Grus canadensis*	Aquatic invertebrates and plants	Summer
Herbivore	American wigeon	*Anas americana*	Mainly plants (stems, leaves, grains, seeds)	Year-round
Herbivore	Canada goose	*Branta canadensis*	Seeds, berries and grain	Year-round
Herbivore	Chipping sparrow	*Spizella passerina*	Mainly seeds and fruits, some insects	Summer
Herbivore	House finch	*Carpodacus mexicanus*	Mainly plants (seeds, fruits, and leaf buds)	Year-round
Herbivore	House sparrow	*Passer domesticus*	Mainly grains, seeds, and few insects	Year-round
Herbivore	Mourning dove	*Zenaida macroura*	Mainly seeds	Year-round
Herbivore	Pine siskin	*Carduelis pinus*	Mainly seeds	Year-round
Herbivore	Red-winged blackbird	*Agelaius phoeniceus*	Mainly plant mater and some insects	Year-round
Insectivore	Barn swallow	*Hirundo rustica*	Flying insects	Summer
Insectivore	Cliff swallow	*Petrochelidon pyrrhonota*	Flying insects	Summer
Insectivore	Common yellowthroat	*Geothlypis trichas*	Insects and spiders	Summer

Table 2.18
Bird Species Identified at or near the Facility

Feeding Group	Common Name	Scientific Name	Feeding Preferences[a]	Residency Status[a]
Insectivore	Eastern kingbird	*Tyrannus tyrannus*	Mainly insects	Summer
Insectivore	Golden-crowned kinglet	*Regulus satrapa*	Insects, mites and spiders.	Year-round
Insectivore	House wren	*Troglodytes aedon*	Terrestrial insects	Summer
Insectivore	Killdeer	*Charadrius vociferus*	Mainly terrestrial invertebrates (earthworms, grasshoppers, beetles, snails)	Summer
Insectivore	Marsh wren	*Cistothorus palustris*	Insects	Summer
Insectivore	Tree swallow	*Tachycineta bicolor*	Mainly flying insects	Summer
Insectivore	Willow flycatcher	*Empidonax traillii*	Insects	Summer
Insectivore	Wilson's warbler	*Wilsonia pusilla*	Mainly flying insects, spiders, beetles, and caterpillars	Summer
Insectivore	Yellow warbler	*Dendroica petechia*	Insects and arthropods	Summer
Omnivore	American crow	*Corvus brachyrhynchos*	Insects, amphibians, reptiles, small birds and mammals, birds' eggs, nestlings and fledglings, grain crops, seeds and fruits, carrion, and discarded human food	Year-round
Omnivore	American goldfinch	*Spinus tristus*	Seeds and insects	Year-round
Omnivore	American redstart	*Setophaga ruticilla*	Insects, seeds, and berries	Summer
Omnivore	American robin	*Turdus migratorius*	Insects, fruits, berries, and worms	Year-round
Omnivore	American tree sparrow	*Spizella arborea*	Spiders, seeds of grass, sedge, forbs, buds, and berries	Winter
Omnivore	Black-billed magpie	*Pica pica*	Ground-dwelling arthropods, seeds, and carrion	Year-round
Omnivore	Black-capped chickadee	*Poecile atricapillus*	Insects, seeds, and fruits	Year-round
Omnivore	Blue winged teal	*Anas discors*	Aquatic invertebrates, seeds, grains, duckweeds, and algae	Summer
Omnivore	Bohemian waxwing	*Bombycilla garrulus*	Fruits and insects	Winter
Omnivore	Brown-headed cowbird	*Molothrus ater*	Arthropods and seeds	Summer
Omnivore	California gull	*Larus californicus*	Insects, oligochaetes, crustaceans, amphibians, birds, and plant material	Summer
Omnivore	Cedar waxwing	*Bombycilla cedrorum*	Cedar cones, fruits, and insects	Year-round
Omnivore	Common raven	*Corvus corax*	Insects, fruits, grains, small animals, and carrion	Year-round
Omnivore	European starling	*Sturnus vulgaris*	Invertebrates, fruits, berries, grains, and seeds	Summer
Omnivore	Gray catbird	*Dumetella carolinensis*	Insects and fruit	Summer
Omnivore	Gray partridge	*Perdix perdix*	Grain, seeds, and insects	Year-round
Omnivore	Horned lark	*Eremophila alpestris*	Seeds and insects	Year-round
Omnivore	Lazuli bunting	*Passerina amoena*	Insects and seeds	Summer
Omnivore	Mallard	*Anas platyrhynchos*	Seeds, plants, and aquatic insects	Year-round

Table 2.18
Bird Species Identified at or near the Facility

Feeding Group	Common Name	Scientific Name	Feeding Preferences[a]	Residency Status[a]
Omnivore	Mountain bluebird	*Sialia currucoides*	Insects and fruit	Summer
Omnivore	Mountain chickadee	*Poecile gambeli*	Insects and seeds	Year-round
Omnivore	Northern flicker	*Colaptes auratus*	Insects, fruits and seeds	Year-round
Omnivore	Northern oriole	*Icterus galbula*	Insects and fruits	Summer
Omnivore	Orange-crowned warbler	*Vermivora celata*	Insects, fruits and seeds	Summer
Omnivore	Red-breasted Nuthatch	*Sitta canadensis*	Insects and seeds	Year-round
Omnivore	Snow bunting	*Plectrophenax nivalis*	Seeds, buds, and invertebrates	Winter
Omnivore	Song Sparrow	*Melospiza melodia*	Seeds, fruits, and invertebrates	Year-round
Omnivore	Townsend's solitaire	*Myadestes townsendi*	Insects and seeds	Year-round
Omnivore	Veery	*Catharus fuscenscens*	Fruit and insects	Summer
Omnivore	Vesper sparrow	*Pooecetes gramineus*	Insects and seeds	Summer
Omnivore	Warbling vireo	*Vireo gilvus*	Insects and some fruit	Summer
Omnivore	Western kingbird	*Tyrannus verticalis*	Insects and berries	Summer
Omnivore	Western meadowlark	*Sturnella neglecta*	Grains, seeds, and insects	Summer
Omnivore	Yellow-headed blackbird	*Xanthocephalus xanthocephalus*	Aquatic insects, grains and seeds	Summer
Piscivore	American white Pelican	*Pelecanus erythrorhynchos*	Mainly fish	Summer
Piscivore	Belted kingfisher	*Megaceryle alcyon*	Mainly fish, also mollusks, crustaceans, insects, amphibians, reptiles, young birds, small mammals, and berries	Year-round
Piscivore	Common merganser	*Mergus merganser*	Mainly fish, but will also eat insects, mollusks, crustaceans, worms, frogs, small mammals, birds, and plants	Year-round
Piscivore	Double-crested Cormorant	*Phalacrocorax auritus*	Mainly fish	Summer
Piscivore	Great blue heron	*Ardea herodius*	Mostly fish and amphibians, reptiles, invertebrates, mammals, and birds	Year-round
Piscivore	Great egret	*Ardea alba*	Mainly fish and some amphibians, insects, and mammals	Summer
Piscivore	Osprey	*Pandion haliaetus*	Primarily fish	Summer

Note: (a) Feeding preference and residency status information obtained from the Montana State Field Guide (State of Montana, 2010).

Mammals

Signs of mammals (*e.g.*, tracks, scat) or observations of mammals at or near the Facility have been recorded during Spring of 1989 and Summer of 2010 (Western Technology and Engineering, Inc., 1989; Appendix A). All of these species are year-round residents in Helena Valley. Mammals that were identified as using habitat at or near the Facility were grouped into the following general feeding guilds:

- **Carnivores** – mammals that feed mainly on small mammals, birds, reptiles and amphibians;
- **Invertivores** – mammals that feed primarily on terrestrial invertebrates and may eat small amounts of plant material;
- **Omnivores –** mammals that feed on plants and animals;
- **Herbivores** – mammals that feed predominantly on plant material; and
- **Piscivores** – mammals that feed predominantly on fish.

A summary of the mammals observed at or near the Facility and their feeding preferences are presented in Table 2.19.

Table 2.19
Mammals Identified at or near the Facility

Feeding Group	Common Name	Scientific Name	Feeding Preferences[a]
Carnivore	Badger	*Taxidea taxus*	Mammals, birds, reptiles, amphibians, and some plants
Carnivore	Coyote	*Canis latrans*	Mammals, birds, invertebrates, plants, carrion
Carnivore	Red fox	*Vulpes vulpes*	Small mammals and birds
Herbivore	Beaver	*Castor canadensis*	Woody and herbaceous plants
Herbivore	Columbian ground squirrel	*Spermophilus columbianus*	Grasses, leaves, bulbs, fruits, and seeds
Herbivore	Mountain cottontail	*Sylvilagus nuttallii*	Plant material (sagebrush)
Herbivore	Muskrat	*Ondatra zibethicus*	Shoots, roots, bulbs, and leaves of aquatic plants
Herbivore	Northern pocket gopher	*Thomomys talpoides*	Underground plant parts
Herbivore	Porcupine	*Erethizon dorsatum*	Woody shrubs and trees, foliage, forbs, grasses, and sedges
Herbivore	Pronghorn	*Antilocapra americana*	Forbs and grasses
Herbivore	Red squirrel	*Tamiasciurus hudsonicus*	Buds, seeds, berries, conifer cones
Herbivore	Vole spp.	*Microtus spp.*	Grasses, sedges, herbaceous plants
Herbivore	Western jumping mouse	*Zapus princeps*	Seeds
Herbivore	White tailed jackrabbit	*Lepus townsendii*	Plant material
Herbivore	White-tailed deer	*Odocoileus virginianus*	Leaves, twigs, fruits, berries, and forbs
Herbivore	Yellow-pine chipmunk	*Tamias amoenus*	Fruits, leaves, and seeds
Invertivore	Masked shrew	*Sorex cinereus*	Terrestrial invertebrates
Omnivore	Deer mouse	*Peromyscus maniculatus*	Seeds and invertebrates
Omnivore	Raccoon	*Procyon lotor*	Carrion, mammals, birds, reptiles, insects, amphibians, grains, nuts, and fruits
Omnivore	Striped skunk	*Mephitis mephitis*	Small mammals, amphibians, reptiles, berries, fruits, garbage, carrion, and arthropods
Piscivore	Mink	*Mustela vison*	Fish, mammals, invertebrates, birds, reptiles, amphibians

Note: (a) Feeding preferences obtained from the Montana State Field Guide (State of Montana, 2010).

Amphibians and Reptiles

Amphibian and reptile species have not been exhaustively characterized in the vicinity of the Facility. A few species were observed during site investigations, including garter snakes (*Thamnophis spp.*) in the riparian area of Prickly Pear Creek, Columbia spotted frogs (*Rana luteiventris*) in the area between Prickly Pear Creek and Upper Lake Marsh, and turtles (*Chrysemys spp.*) in Lower Lake (Western Technology and Engineering, Inc., 1989; Appendix A). Amphibian and reptile species known to be present in Helena Valley are presented in Table 2.20.

Table 2.20
Amphibians and Reptiles Potentially Present at or near the Facility

Feeding Group	Common Name	Scientific Name	Feeding Preferences[a]
Amphibians			
Carnivore	Boreal chorus frog	*Pseudacris maculata*	Ants, spiders, flies, beetles, aphids and other insects (adult)
Carnivore	Columbia spotted frog	*Rana luteiventris*	Ground insects (adult)
Carnivore	Long-toed salamander	*Ambystoma macrodactylum*	Aquatic and terrestrial invertebrates
Carnivore	Northern leopard frog	*Rana pipiens*	Invertebrates (adult)
Carnivore	Plains spadefoot	*Spea bombifrons*	Terrestrial invertebrates (adult)
Carnivore	Western toad	*Bufo boreas*	Terrestrial invertebrates (adult)
Reptiles			
Carnivore	Common gartersnake	*Thamnophis sirtalis*	Amphibians, slugs, birds, and small mammals
Carnivore	Eastern racer	*Coluber constrictor*	Small mammals, lizards, and amphibians
Carnivore	Gophersnake	*Pituophis catenifer*	Rodents, rabbits, and birds
Carnivore	Prairie rattlesnake	*Crotalus viridis*	Small mammals and birds
Carnivore	Rubber boa	*Charina bottae*	Small mammals
Carnivore	Terrestrial gartersnake	*Thamnophis elegans*	Amphibians, slugs, leaches, and fish
Omnivore	Painted turtle	*Chrysemys picta*	Aquatic invertebrates and plant material

Note: (a) Feeding preferences obtained from Montana State Field Guide (State of Montana, 2010).

Sensitive Species

Endangered, threatened, proposed, and candidate species have been listed for each Montana county by US FWS and the Montana Natural Heritage Program (MNHP). Threatened and endangered species are not expected to occur at the Facility or in the surrounding areas. Species that are listed as threatened or endangered by US FWS, the United States Forestry Service (US FS), and the Bureau for Land Management (BLM) for Lewis and Clark County are summarized in Table 2.21 (MNHP, 2010; US FWS, 2010).

Table 2.21
Montana Species of Concern for Lewis and Clark County

Group	Scientific Name	Common Name	US FWS[a]	US FS[b]	BLM[b]
Mammals	*Corynorhinus townsendii*	Townsend's Big-eared Bat		S	S
Mammals	*Canis lupus*	Gray Wolf	LE, XN	S	S
Mammals	*Cynomys ludovicianus*	Black-tailed Prairie Dog		S	S
Mammals	*Euderma maculatum*	Spotted Bat		S	S
Mammals	*Gulo gulo*	Wolverine		S	S
Mammals	*Lynx canadensis*	Canada Lynx	LT	T	SPS
Mammals	*Martes pennanti*	Fisher		S	S
Mammals	*Myotis thysanodes*	Fringed Myotis			S
Mammals	*Synaptomys borealis*	Northern Bog Lemming		S	
Mammals	*Ursus arctos*	Grizzly Bear	LT, XN, DM	T	SPS
Mammals	*Mustela nigripes*	Black-footed ferret	LE, XN	T	SPS
Birds	*Accipiter gentilis*	Northern Goshawk			S
Birds	*Aechmophorus clarkii*	Clark's Grebe			
Birds	*Ammodramus bairdii*	Baird's Sparrow			S
Birds	*Ammodramus savannarum*	Grasshopper Sparrow			
Birds	*Anthus spragueii*	Sprague's Pipit			S
Birds	*Aquila chrysaetos*	Golden Eagle			S
Birds	*Ardea herodias*	Great Blue Heron			
Birds	*Buteo regalis*	Ferruginous Hawk			S
Birds	*Calcarius mccownii*	McCown's Longspur			S
Birds	*Calcarius ornatus*	Chestnut-collared Longspur			S
Birds	*Carpodacus cassinii*	Cassin's Finch			
Birds	*Catharus fuscescens*	Veery			
Birds	*Certhia americana*	Brown Creeper			
Birds	*Cygnus buccinator*	Trumpeter Swan		S	S
Birds	*Dolichonyx oryzivorus*	Bobolink			S
Birds	*Dryocopus pileatus*	Pileated Woodpecker			
Birds	*Falco peregrinus*	Peregrine Falcon	DM	S	S
Birds	*Gavia immer*	Common Loon		S	S
Birds	*Gymnorhinus cyanocephalus*	Pinyon Jay			
Birds	*Haliaeetus leucocephalus*	Bald Eagle	DM		S
Birds	*Himantopus mexicanus*	Black-necked Stilt			
Birds	*Histrionicus histrionicus*	Harlequin Duck		S	S
Birds	*Lagopus leucura*	White-tailed Ptarmigan			
Birds	*Leucosticte tephrocotis*	Gray-crowned Rosy-Finch			
Birds	*Melanerpes lewis*	Lewis's Woodpecker			
Birds	*Nucifraga columbiana*	Clark's Nutcracker			
Birds	*Numenius americanus*	Long-billed Curlew			S
Birds	*Oreoscoptes montanus*	Sage Thrasher			S
Birds	*Otus flammeolus*	Flammulated Owl		S	S
Birds	*Picoides arcticus*	Black-backed Woodpecker		S	S
Birds	*Podiceps auritus*	Horned Grebe			
Birds	*Spizella breweri*	Brewer's Sparrow			S

Group	Scientific Name	Common Name	US FWS[a]	US FS[b]	BLM[b]
Birds	*Troglodytes troglodytes*	Winter Wren			
Birds	*Tympanuchus phasianellus*	Sharp-tailed Grouse			
Amphibians	*Bufo boreas*	Western Toad		S	S
Amphibians	*Bufo cognatus*	Great Plains Toad		S	S
Amphibians	*Spea bombifrons*	Plains Spadefoot		S	S
Fish	*Oncorhynchus clarkii lewisi*	Westslope Cutthroat Trout		S	S
Fish	*Salvelinus confluentus*	Bull Trout	LT	T	SPS
Fish	*Phoxinus eos*	Northern Redbelly Dace			
Fish	*Thymallus arcticus*	Arctic Grayling		S	S
Invertebrates	*Oreohelix alpina*	Alpine Mountainsnail			
Invertebrates	*Oreohelix elrodi*	Carinate Mountainsnail			
Invertebrates	*Margaritifera falcata*	Western Pearlshell		S	
Plants	*Amerorchis rotundifolia*	Round-leaved Orchis		S	
Plants	*Astragalus convallarius*	Lesser Rushy Milkvetch			S
Plants	*Atriplex truncata*	Wedge-leaved Saltbush			
Plants	*Botrychium ascendens*	Upward-lobed Moonwort		S	
Plants	*Botrychium sp. (SOC)*	Moonworts			
Plants	*Cardamine rupicola*	Cliff Toothwort			
Plants	*Carex livida*	Pale Sedge			
Plants	*Cirsium longistylum*	Long-styled Thistle			
Plants	*Cypripedium passerinum*	Sparrow's-egg Lady's-slipper		S	
Plants	*Delphinium bicolor ssp. calcicola*	Limestone Larkspur			
Plants	*Downingia laeta*	Great Basin Downingia			
Plants	*Draba densifolia*	Dense-leaf Draba			
Plants	*Drosera anglica*	English Sundew		S	
Plants	*Drosera linearis*	Linear-leaved Sundew		S	
Plants	*Eleocharis rostellata*	Beaked Spikerush		S	S
Plants	*Erigeron lackschewitzii*	Lackschewitz' Fleabane		S	
Plants	*Erigeron linearis*	Linear-leaf Fleabane			S
Plants	*Listera borealis*	Northern twayblade			
Plants	*Mimulus suksdorfii*	Suksdorf Monkeyflower			
Plants	*Phlox kelseyi var. missoulensis*	Missoula Phlox		S	S
Plants	*Physaria klausii*	Divide Bladderpod			
Plants	*Physaria saximontana var. dentata*	Rocky Mountain Twinpod			
Plants	*Polygonum austiniae*	Austin's Knotweed		S	S
Plants	*Saussurea densa*	Dwarf Saw-wort			
Plants	*Schoenoplectus subterminalis*	Water Bulrush		S	
Plants	*Scorpidium scorpioides*	Scorpidium moss		S	
Plants	*Solorina spongiosa*	Fringed Chocolate Chip Lichen			
Plants	*Sphagnum fimbriatum*	Fringed Bogmoss			

Notes:

Source: MNHP (2010).

(a) US FWS Codes = LT - Listed threatened, XN - Experimental - Nonessential population, DM - Recovered, delisted, and being monitored, LE - Listed endangered.

(b) USFS/BLM Codes = S – Sensitive, T – Threatened, SPS – Special Status Species.